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## Article

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# Research in Agricultural Futures Markets: Integrating the Finance and Marketing Approach

## Forschung im Warenterminhandel: Integration von Finanz- und Marketingansatz

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### Abstract

In a brief literature review, we discuss how our insight into the grounds of existence of futures markets has changed from the initial insurance perspective, to the arbitrage perspective, to the portfolio perspective, and to the current institutional perspective. We discuss futures market research within agricultural marketing, on the one hand, and within finance, on the other hand. The research within these two disciplines may be considered complementary. Subsequently, a new research model is presented which integrates both strains of research. The new research model is illustrated for the Dutch hog industry. This model is a powerful instrument in the development of new commodity futures contracts. Finally, a future research agenda for agricultural economists is presented.

### Key words

agricultural futures markets, research approaches, finance-marketing integration

### Zusammenfassung

In einer kurzen Literaturzusammenfassung diskutieren wir, inwieweit sich unsere Einsicht in die Grundsteine der Existenz von Terminkontrakten von der anfänglichen Versicherungsperspektive, der Arbitrageperspektive, der Portfolioperspektive, zur derzeitigen Institutionenperspektive geändert hat. Wir erläutern dies einerseits im Rahmen des Agrarmarketings und andererseits im Rahmen finanzieller Aspekte. Die Forschung innerhalb dieser beiden Disziplinen kann als komplementär angesehen werden. Infolgedessen präsentieren wir einen neuen Forschungsansatz, der diese beiden bisherigen Forschungsansätze integriert. Die Anwendung des neuen Forschungsansatzes ist am Beispiel der niederländischen Schweine-Industrie dargestellt. Dieser neue Ansatz eignet sich besonders für die Entwicklung neuer agrarischer Terminkontrakte. Weiterhin wird eine Terminmarktforschungsagenda für Agrarökonomien vorgestellt.

### Schlüsselwörter

Warenterminhandel, Forschungsansätze, Finanz-Marketing-Integration

### 1. Introduction

Agricultural futures markets have recently regained the interest of farmers, businesses, research institutions, and governments. This renewed interest results from the increasing volatility of prices for agricultural raw materials. In turn, this volatility in prices reflects the shift that has taken place in the European Union's joint agricultural policy: from price support to income support and to market liberalization under the terms of the WTO. These developments have triggered revived interest of agricultural economists in the functioning of agricultural futures markets. Various optimal hedging models have been developed and applied to European agricultural markets (BERG, 1987; ENNEW et al., 1992; PENNINGS and MEULENBERG, 1997; MAHUL and VERMERSCH, 2000). Although these models suggest that using futures contracts is beneficial for farmers, the volume in European agricultural futures contracts is relatively low compared to U.S. agricultural futures contracts or to financial futures contracts. Hence, there is a need to better understand why agricultural futures contracts fail or succeed. In order to answer this research question, we need to understand farmers' revealed behavior. In this paper we assess different approaches that can be taken to study agricultural futures markets. Subsequently, we provide a research framework that integrates the different approaches in agricultural futures research and illustrate their application using the Dutch hog industry. In this context, we analyze the functions of futures contracts to better understand farmers' hedging behavior (i.e., what do futures contracts offer farmers?). We first provide an overview of the reasons for the existence and the functions of futures markets, paying special attention to how hedging theories have evolved over time. Next, we evaluate futures market research within the financial economics discipline on the one hand, and within the marketing discipline on the other hand. The research from both disciplines is complementary. Therefore, we propose a framework that integrates both

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strains of research and suggest an agenda for prospective futures research.

## 2. Old perspectives on futures markets

### 2.1 The insurance perspective (1919-1952)

The pioneers of futures market theory focused mainly on the reasons for the existence of futures markets and their proper functioning. Futures markets were presumed to exist because they allowed for the transfer of risk. HOFFMAN (1932: 382) stated that "hedging is risk shifting", where the word 'hedging' refers to taking a seller or buyer position in the futures market. This perspective on hedging as a kind of insurance where risk is transferred from one market participant to another had already been formulated earlier by the prominent English economist MARSHALL (1919: 260): "the hedger does not speculate: he insures". Other famous founders of the economic science, such as KEYNES (1930), HICKS (1939) and KALDOR (1940), also approached hedging from concepts like risk avoidance and insurance. In this view, any loss incurred by a hedger on a completed hedge is nothing but an insurance premium paid to the speculator willing to assume the risk. BLAU (1944) argued that "commodities futures markets are market organizations developed especially to facilitate the shifting of risks that stem from unknown future changes in the prices of commodities; that is, risks of such a nature that they cannot be covered by a regular insurance". Until the 1940s, the insurance perspective remained the dominant explanation for corporate use of futures markets.

### 2.2 The arbitrage perspective (1953-1960)

After World War II, the insurance perspective began to be disputed. WORKING (1953, 1954) criticized the notion of futures markets as an insurance against risks by claiming that a profit motive is involved through the exploitation of (expected) changes of the basis (local cash price minus futures price) that is, the exploitation of profit opportunities that arise through anticipated price fluctuations of the futures market in relation to the fluctuations in the spot market. In this view, hedging was first and foremost a kind of *arbitrage*, only entered into if the hedger perceived a promising profit opportunity.<sup>1</sup> Later, WORKING (1962) changed his position by postulating that (short) hedgers often lose money to speculators on futures transactions, even in periods when the market prices of the contracts under consideration have gone down. WORKING (1962) explained this observation through the highs and lows that occur regularly when hedgers buy or sell futures contracts. Thus, according to WORKING (1962), hedgers pay a price to speculators, in that they carry the transaction costs in return for a fast listing of their purchasing or sales orders. However, this explanation falls back on the aforementioned concept of insurance: the fast execution of the hedgers'

orders is meant to shorten the period during which their commodities are uncovered and therewith exposed to the risk of price changes.

### 2.3 The portfolio perspective (1960-1980)

The introduction of portfolio theory by MARKOWITZ (1952), JOHNSON (1960), and STEIN (1961) meant the rehabilitation of risk reduction in futures market theory. The portfolio approach sees the hedger as someone who maximizes the expected utility of a portfolio consisting of spot and futures contracts. In this framework, the hedger explicitly weighs risk and return against one another. Using portfolio theory to explain market participants' activities in the futures trade makes risk the central concept in the issue of why to use futures contracts.

### 2.4 The institutional perspective (since 1981)

Until the 1980s, hedging theories had not taken into account alternative instruments for risk management. TELSER (1981) shifted this perspective by contrasting the properties of futures contracts and forward contracts. TELSER (1981) postulated that contracts made at organized futures markets exist because they are superior to informal forward contracts. Futures contracts are based on an organized market with an elaborate set of written rules, arbitration boards, and a limited market membership. Through their standardization and rules, futures contracts ensure liquidity and eliminate the counter-party default risk. In contrast, forward contracts are based on both parties' mutual trust.

According to TELSER (1981), risk reduction is the motive for using futures markets, but he recognizes that there are other instruments available. A company that wishes to reduce its price risk does not need an organized futures market to do so: entering into forward contracts in the spot market would also be appropriate in such a situation. In this view, the use of futures contracts no longer primarily depends on a company's objective to limit its risks, but also on the properties of the futures market as an institution.

## 3. A new perspective on agricultural futures markets

All of the reviewed theories view hedging as a transaction in the futures market. However, we propose to analyze hedging based on the decision-making behavior of companies in the spot markets. Our attention is directed at transactions between companies, aimed at the delivery and acceptance of commodities. Thus, we focus on the core activities of a company: the transactions that generate the flow of commodities that enter the company (input) and leave the company (output). The type of transaction between companies characterizes their business relationship. The agreement on which the transaction is based minimally specifies the place of delivery, the date of delivery, the quantity and quality of the product or service, and the price (for example CROCKER and MASTEN, 1991).

In transaction relationships, corporate power may be used to achieve the most favorable contract relationship. The use of this power, however, may lead to tense relationships and conflicts. Well-known examples of this are the market channels in agribusiness, where the concentration of the

<sup>1</sup> According to WORKING (1953, 1954), the hedging of futures contracts is the conclusion of a purchasing or sales contract on standardized terms, both set down and supervised by a futures exchange. These contracts are the temporary replacements of an intended purchasing or sales contract later on. WORKING (1962) discerned different categories of hedges: the cost-bearing, operational, selective, anticipating, and purely risk-averse hedge. For a detailed discussion see KAMARA (1982).

upstream channel members has led to power shifts, and where the contract preferences are vastly different (see also MESSINGER and NARASIMHAN, 1995; PENNINGS and WANSINK, 2003). The tensions which arise from different transaction preferences may be solved using services offered by futures markets. These services may supplement the price element of a transaction, such that it becomes interesting to both parties, even if it is not the preferred transaction of one of the parties. A general definition of a hedging service would then be: *a service that enables a company to buy or sell products forward, at a fixed price, without forcing the company to refrain from a cash transaction.*

The old notion of risk management still resonates in this transaction-relation approach: the preferred transaction relationship of each individual company is driven by the desire for risk reduction. In this sense, our approach should be seen as a supplement to, rather than an alternative for, the existing theories. Our new perspective incorporates how futures markets influence management: without hedging services, certain transaction relationships between companies probably would not exist. Thus, the futures market facilitates market channels. This position is consistent with HIRSHLEIFER (1988) and PENNINGS and LEUTHOLD (2000b), who argues that the absence or presence of a futures market influences the optimal organization of production. The interpretation of hedging as the management of transaction relationships predicts an active futures trade in market channels with large differences in power and transaction preferences. As such, it is time for new research into the motivation to hedge.

#### 4. A new research model

Based on the different perspectives on futures markets, several theories have been proposed to explain the success or failure of futures contracts. Those theories are rooted in financial economics and are aimed at the technical aspects of the futures trade. Two main approaches can be discerned here: the commodity-characteristics approach and the contract-design approach (BLACK, 1986). The commodity-characteristics approach selects commodities that fit for futures trade based on a long list of prescribed characteristics, such as homogeneity and large, unpredictable price fluctuations. Thus, the commodity-characteristics approach focuses on the technical aspects of the underlying *commodity*. The contract-design approach, on the other hand, sees the contract specifications as crucial to the viability of a futures contract. Thus, it focuses on the technical aspects of the *contract*.

Both approaches provide the necessary conditions for successful futures trade, though not the sufficient ones. While both approaches provide insight into the conditions that make a futures contract successful, they pass over one cardinal aspect of success: the farmer's decision-making process, which leads to the final choice of whether or not to use futures contracts. After all, a futures market is made or broken by the number of trading farmers and the number of transactions per farmer.

In order to fill the gap regarding decision-making behavior that has been left by the commodity-characteristics approach and the contract-design approach, we propose a

research model that integrates both the financial-economic and the marketing approach. This integration is achieved by a development process for futures contracts on commodities in which both the technical properties necessary for futures trade to take place and the decision-making behavior of potential participants are researched simultaneously.

The financial-economic and the marketing approach are both characterized by the type of information they use. Therefore, the distinction between the types of information needed is crucial to understanding the research model. The financial-economic approach uses technical information. Technical information includes prices, return ratios, transaction volumes, and the historical data on each of these, all for different locations and markets. The marketing-management approach, on the other hand, uses client-specific information. This type of information includes time preferences, choice criteria, investment opportunities, and risk preferences of individual economic decision makers (PENNINGS and GARCIA, 2001). Client-specific information is essential to determining the demand for a particular contract and the associated profit opportunities in the market. Such information is useful in selecting target markets. Targeting market segments and developing effective positioning strategies requires that exchange managers know how current and potential clients value the attributes of the services offered by futures markets.

Designing a futures contract based solely on the clients' needs might conflict with technical feasibility. Vice versa, technical feasibility alone does not make satisfied clients. In order to profit optimally from the integration, the financial-economic approach should shift its perspective from portfolio management to commodity futures market management. This implies, for example, making sure that the measures developed within financial economics also provide exchange management with ways to improve hedging efficiency (PENNINGS and MEULENBERG, 1997). The marketing-management approach should concentrate on gaining a better understanding of the decision-making process of companies concerning the use of price-risk reduction instruments. A better insight into the reasons why companies decide the way they do is of special importance to futures exchanges.

The role of decision-making behavior hence becomes a second key element in the research model. Traditional financial-economic research is often normative and assumes that the economic decision maker has a clear-cut, objective function, as well as carefully defined and stable preferences. Optimal behavior occurs when the decision maker acts rationally and in his own interest. The decision maker knows all the alternatives, assigns a utility value to each, and selects those alternatives (e.g. behavioral patterns) that maximize his overall utility. However, the work of TVERSKY and KAHNEMAN (1981) on assessment and uncertainty has demonstrated numerous circumstances in which the ideal notion of the economic decision maker does not apply due to flawed rationality (THALER, 1997). Anomalies occur especially with choices under uncertainty. In contrast to the traditional economic views, behavioural research acknowledges that the focus should be on the process of decision making in order to lay bare the decision-making behaviour. In the behavioural literature, the decision-making process is viewed as a problem-solving process, driven by rules and rationality. Several heuristic rules have

been identified to solve problems and to provide behavioural strategies.

There is a major difference between the economic and the behavioural science approach. The economic approach is based on inputs, which, together with known, exactly defined, internally coherent, and stable preferences, transform into behaviour. The behavioural approach, on the other hand, stresses that the decision maker's preferences are the result of a constructive process, in which a hierarchy of goals, interpretation of the situation, as well as several environmental clues, play a key role.

Our research model uses the marketing-management approach as its starting point, but also takes into account the technical relationships in futures trade. As such, it puts futures market research back on the research agenda of agricultural marketing. The model incorporates both the choice process, i.e. the needs of potential market participants, and the technical conditions for futures trade simultaneously into the research process as both aspects yield valuable information. The results from a technical analysis may be used to improve the specifications of a futures contract. This improvement can then be tested through new marketing research. Conversely, the information on decision-making behavior may be used to find out what factors exactly are relevant to the decision-making behavior of (potential) market participants. This information can then be used to modify the contract specifications. Hence, research into decision-making behaviour and technical analysis is interdependent and has to be carried out simultaneously in order to profit from the other's findings. This notion is reflected in figure 1.

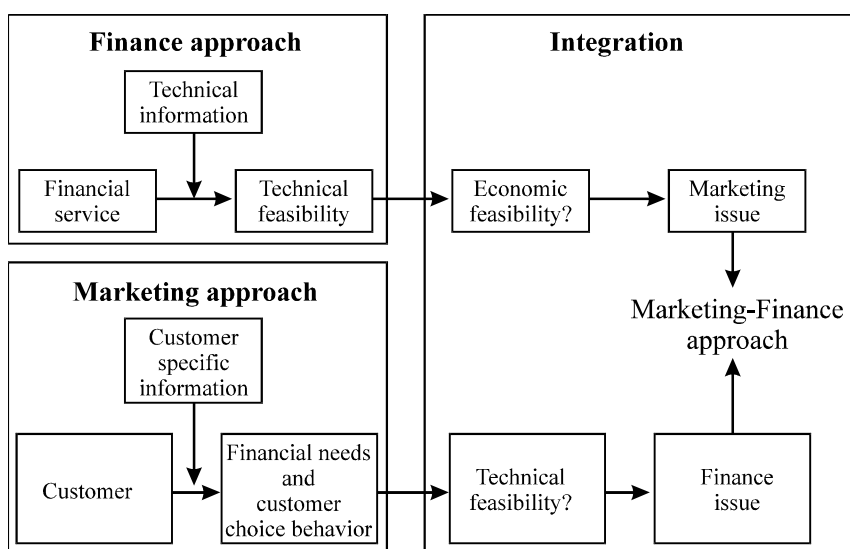
## 5. An illustration of the new research model

We illustrate the new research model by applying it to the Dutch hog industry, because it represents a domain in which the technical conditions, as given in the commodity characteristic approach, have all been met. The commodity is homogeneous, the underlying cash market is broad, there are many participants, and large, unpredictable, price fluctuations exist.<sup>2</sup> From a technical perspective, the conditions would seem very favorable for a hog futures contract. However, only 13% of Dutch hog farmers actually use futures contracts to cover their price risk (PENNINGS and GARCIA, 2001). PENNINGS and LEUTHOLD (2000a) studied the Dutch hog futures market in a first attempt using a behavioral approach. Our empirical research into the technical side of that market complements their behavioural approach as the second component. Therefore, the empirical domain of the Dutch hog futures market is considered ideal to illustrate the contribution of the new integrated research model.

We evaluate the different relationships between hedging effectiveness and trading volume as the financial-economic component on one hand, and between farmers' characteristics and the use of futures as the behavioral component on the other hand, thereby integrating both approaches in order to gain a better understanding of the factors that contribute to the performance of the hog futures market. The input for this research consists of transaction-specific data for the nearby hog futures contract traded at Euronext and hog cash prices from the central Dutch market over the period 1990-1998, as well as a survey of 440 farmers by

means of personal-computer guided interviews, conducted in 1998. The survey, described in detail in PENNINGS and LEUTHOLD (2000a), confronted farmers with statements about futures contracts that were measured on bi-polar nine-point Likert scales with the end-poles labeled as "strongly disagree" and "strongly agree". The statements included characteristics such as market orientation, level of understanding, risk attitude, perceived risk exposure, and perceived performance. Because farmers often base their decisions on the opinions of the members of their decision unit (such as spouse, partner, banker, and advisors), the survey also included questions related to farmers' perceptions of the extent to which significant others think that the farmers

**Figure 1: Marketing-finance approach towards futures market research**



Source: PENNINGS (1998)

The challenge for future research is to use this new integrated approach as a basis for a theoretical model that is able to explain the decision-making behavior of farmers and agribusiness companies and to translate this behavior into concrete characteristics of futures contracts and of the organization of futures trade. Future research will have to pay special attention to the heterogeneity in the decision-making behavior, so that an optimal futures contract profile might be developed for each segment (PENNINGS and GARCIA, 2003).

should engage in futures trading. The results of our technical research and of the behavioral approach by PENNINGS and LEUTHOLD (2000a) are interpreted in the context of managerial decision making concerning futures contract design and viability.

<sup>2</sup> Dutch hog prices fluctuate widely. The coefficient of variation (CV), based on daily observations over the period 1990-1997, is 0.19, which is relatively high when compared to, for example, U.S. soybeans (CV 0.14).

## 5.1 Conceptual framework and research design

A key aspect of futures market performance is the degree of liquidity in the market. A futures market is considered liquid if market participants can buy or sell futures contracts quickly, with little price effect resulting from their transactions. However, in thin markets, the transactions of individual hedgers may have significant price effects and result in substantial transaction costs (KYLE, 1985). This phenomenon, which we will refer to as lack of market depth, is particularly important for relatively small commodity futures markets and might be especially true for new futures markets. We therefore propose to use an extended version of the EDERINGTON (1979) measure that includes market depth risk. PENNINGS and MEULENBERG (1997) showed that, when market depth risk is included in the EDERINGTON (1979) measure, hedging effectiveness can be expressed as:

$$(1) \quad HE = - \frac{b^* (\sigma_f^2 + \sigma_{md}^2 - 2\sigma_{fmd}) + b^* (-2\sigma_{sf} + 2\sigma_{smd})}{\sigma_s^2}$$

where  $\sigma_s^2$ ,  $\sigma_f^2$ ,  $\sigma_{sf}$ ,  $\sigma_{fmd}$ , and  $\sigma_{smd}$  represent the variances and the covariances of the prices (subscripts  $s$  and  $f$  denote spot and futures prices respectively) and market depth cost changes (denoted by  $md$ ) from time 1 to time 2, and  $b^*$  is the risk minimizing hedge ratio with

$$b^* = \frac{\sigma_{sf} - \sigma_{smd}}{\sigma_f^2 + \sigma_{md}^2 - 2\sigma_{fmd}}$$

the measure in (1) reduces to the EDERINGTON (1979) measure.<sup>3</sup>

Market depth costs are calculated as the area between the downward-sloping price path (selling order imbalance) and the price for which the participant enters the futures market (2)

$$(2) \quad MD = PF^1 \cdot N - \sum_{i=1}^N (PF^i)$$

where  $PF^1$  is the futures price at which the participant enters the market,  $PF^i$  is the price of the  $i$ -th futures contract, and  $N$  the total order flow, or as the area between the upward-sloping price path (buying order imbalance) and the price at which the participant enters the futures market (3)

$$(3) \quad MD = \sum_{i=1}^N (PF^i) - PF^1 \cdot N.$$

After obtaining market depth costs, both the EDERINGTON (1979) measure and the extended measure (1) are calculated, and the relationship between hedging effectiveness and volume is empirically investigated. We expect to find that the extended measure has a stronger relationship with volume than the EDERINGTON (1979) measure that does not include market depth risk.

Often, alternative products or services will be available to meet farmers' risk management needs. Therefore, we also

pay attention to the farmers' marketing behavior (GOODWIN and SCHROEDER, 1994). To illustrate the behavioral approach, we also briefly discuss the results of PENNINGS and LEUTHOLD (2000a). A farmer's choice process provides clues about the necessary characteristics of futures contracts in order for them to be preferred over other alternatives. Farmers compare alternatives on the basis of different attributes or dimensions, e.g. the alternative's risk reduction capacity. The farmer's choice for any particular alternative depends on the importance placed on these attributes, as well as on how the alternatives differ in these attributes in the farmer's evaluation. Insight into these attributes and the variables influencing them represents the marketing approach and gives the management of futures exchanges a framework for improving the hedging services provided. Following the proposed research framework, we recognize that farmers make decisions based on their beliefs, which are formed by perceptions.<sup>4</sup> For example, the perceived risk-reduction performance may differ from the actual performance, as reflected by hedging effectiveness measures such as in (1). Moreover, farmers may very well evaluate the hedging service provided by futures exchanges along criteria other than just performance. That is, we take psychological constructs into account (THALER, 1993, 1997).

## 5.2 Results

The hedging effectiveness of the hog futures contract is greater according to the EDERINGTON (1979) measure (0.92) than according to the proposed measure (0.87), which corresponds with our expectations.<sup>5</sup> This result is due to the fact that the proposed measure takes basis risk and market depth risk into account, whereas the EDERINGTON (1979) measure only takes basis risk into account.

To illustrate the relationship between the two hedging effectiveness measures and trading volume, a simple regression model was estimated in which the annual volume in the period 1990-1998 is the dependent variable and the hedging effectiveness (based on the nearby futures contract) the independent variable. Table 1 demonstrates that hedging effectiveness is strongly related to futures contract volume ( $\beta = 0.90$ ,  $t = 7.70$  and  $\beta = 0.99$ ,  $t = 9.09$  for the EDERINGTON (1979) and the extended measure, respectively), which is consistent with the findings of TASHJIAN and MCCONNELL (1989). Moreover, the extended measure has a better fit than the EDERINGTON (1979) measure (adjusted  $R^2$  0.81 vs. 0.90). While it is well-known that liquidity is a key element in futures market performance, we here quantify this

**Table 1: Regression of hedging effectiveness measures on annual volume, 1990-1998**

	$\beta$	t-statistic	p-value	Adjusted $R^2$
EDERINGTON (1979) Measure	0.90	7.70	0.00	0.81
Extended Hedging Effectiveness Measure	0.99	9.09	0.00	0.90

<sup>3</sup> This analysis can only be conducted ex post. Ex post this may help explain why a contract is not successful, but this analysis may not be available ex ante (i.e. when a new contract is being designed).

<sup>4</sup> Beliefs pertain to the degree to which an object (e.g. futures contracts) may have particular consequences, and perceptions reflect the interpretation of these consequences.

<sup>5</sup> Both measures range from 0 to 1, indicating the reduction in the variance of the returns.

effect in terms of a decrease in risk reduction. It appears that the lack of liquidity in the Dutch hog futures market reduces hedging effectiveness by 10%. Furthermore, this reduction in hedging effectiveness has a significant impact on trading volume, as our estimated relationship between the extended hedging effectiveness measure and volume reveals. This finding indicates that market users may take market-depth risk into account when deciding to use futures. Such information is important to exchanges when designing futures contracts.

PENNINGS and LEUTHOLD (2000a, Table 2: 914) evaluate the influence of several variables measured in personal computer-guided interviews on the farmers' probability of using futures across the whole sample, using structural equation models. Assuming that farmers are homogeneous, the decision unit, the perceived performance, exercising entrepreneurial freedom, and the level of understanding are significant in the statistical analysis and have the expected sign. Surprisingly, risk attitude and perceived risk exposure are not significantly related to the probability of using futures (MAKUS et al., 1990; SHAPIRO and BRORSEN, 1988).

However, the sample might not be homogenous, that is, different groups of farmers may use different criteria (attributes) when deciding to use futures. If this is the case, different factors might influence the choice behavior of different farmers and common factors would be weighted differently, resulting in different  $\beta$  coefficients. Using cluster analysis, PENNINGS and LEUTHOLD (2000a) distinguish between two groups of farmers based on their cash-trading behavior (PUNJ and STEWART, 1983). Segment I (N = 120) consists of farmers who sell their hogs to a cooperative. Segment II consists of farmers who sell to a trader (N=320).<sup>6</sup>

The results indicate that for segment I the decision unit, perceived performance, risk attitude, perceived risk exposure, and debt-to-asset ratio impact the use of futures. The latter is consistent with recent findings by SHAPIRO and BRORSEN (1988) and TURVEY and BAKER (1990), who observe a relation between the use of price risk management instruments and the capital structure of the farm. Farmers' probability of using futures in segment II is influenced by market orientation, exercising entrepreneurial freedom, the decision unit, and perceived performance. Hence, accounting for heterogeneity in the sample of farmers identifies additional attributes.

Farmers in segment I seem to use financial structure characteristics (as imbedded in the debt-to-asset ratio, risk attitude, and the perceived risk-reduction exposure) in their decision to engage in futures, whereas the farmers in segment II use marketing characteristics (imbedded in market orientation and exercising entrepreneurial freedom) in their decision to use futures. Farmers in segment I (cooperative farmers) attach a lot of value to 'continuing the firm's operation for successors', whereas farmers who sell to traders (segment II) attach value to 'keeping up with markets and trying to get the high prices'.

### 5.3 Discussion

The financial-economic and behavioral factors found to influence the viability of futures are now integrated into the context of the tools the futures exchange has available. Those tools are linked to the futures exchange's service design and service delivery. Service design refers to the contract specification. Service delivery refers to the way the service is brought to the customer and is the result of the interaction between the futures exchange and the customer, and relates to such factors as the clearing system, accessibility of brokers, and the information provided by the trading system.

Hedging effectiveness is related to service design, and hence, the core activity of the futures exchange. Our results show that the low liquidity in the Dutch hog futures market, i.e. the market depth risk, reduces hedging effectiveness, and that this reduced hedging effectiveness in turn impacts trading volume. Market depth risk relates to the trading system and might be reduced by implementing a mechanism for slowing down the trade process, if order imbalances occur, and by reporting these (imbalances) to improve market depth. LEHMANN and MODEST (1994) report such a mechanism on the Tokyo Stock Exchange, where warning quotas are issued when a portion of the trade is executed at different prices. Also the order book information can be improved by incorporating a mechanism that allows potential participants to view real-time limit orders. Displaying the desired prices and quantities at which participants would like to trade might improve the market depth risk.

PENNINGS and LEUTHOLD (2000a) indicate that the farmer's perceived performance also plays an important role when deciding to use futures contracts, as hedging effectiveness is positive and significantly related to trading volume. Apparently, Dutch hog farmers take liquidity into account, since only 13% of them are using futures. Performance is directly related to contract specification and the trading system, both of which influence the risk reduction capacity of the exchange's service. The members of the decision unit play an important role in the farmer's use of futures, which implies that promotion and education efforts should not only be tailored to farmers, but also to the advisors surrounding them. The farmer's level of understanding of futures is positively related to the probability of using futures, thereby supporting the view that education programs for farmers are valuable.

In segment I, risk attitude and perceived risk exposure were also found to be determinants of futures use. Both elements can be related to the service design, in particular contract specification, which influences the risk reduction capacity of the futures contract, and clearing with respect to credit and default risk. Perceived risk exposure dictates the importance and need of education. The debt-to-asset ratio was an important determinant as well. High-leveraged farmers may find futures an attractive risk-reduction tool, which makes it interesting to specify futures and come up with a portfolio of futures that can reduce fluctuations in farmers' profits. Clearing aspects, especially default risks, are important to high-leveraged farmers.

Farmers who focus on the marketing aspects of their firm operation make up segment II. Market orientation was a

<sup>6</sup> Interestingly, the two segments of farmers do not differ significantly regarding age and education.

determinant when choosing futures. Providing accurate real-time information by the trading system is attractive for this group of farmers. The farmers in this segment value the use of futures as a way to exploit their entrepreneurial freedom, that is, the fact that futures provide them with the opportunity to increase their degree of acting in the market place. The value farmers attach to entrepreneurial freedom presents a challenge to the futures exchange, both in terms of service design and delivery.

PENNINGS and LEUTHOLD (2000a) show that farmers are heterogeneous. Hence, the exchange needs to use different tools for different segments. Identifying the different segments enables the futures exchange to target their marketing efforts. Based on the characteristics of the different segments, the exchange can select a group of potential customers to whom it will offer a risk reduction service designed to match those customers' choice profiles. This implies differentiation of the services offered by the exchange.

The application of the new research model to the Dutch hog industry illustrates the importance of integrating the financial-economic and behavioral approach. For example, the financial (technical) findings are consistent with the behavioral (marketing) approach, which reveals that perceived performance is driving the adoption of futures. On the other hand, the behavioral approach reveals information that is not obtainable by solely employing the financial approach. By taking the heterogeneity of farmers into account, we discover that risk aversion and risk perception are important determinants in the use of futures for a particular segment of farmers only. This, in turn, has great implications for the financial approach as high hedging effectiveness does not guarantee high trading volume. These results carry significant consequences for the management of futures markets in developing and evaluating commodity futures contracts. To shorten the psychological distance between participants and the exchange, and to increase the knowledge of the futures trade and the ease of use of futures contracts, the exchange could develop training programs for farmers. The performance of futures contracts may be increased by introducing a more attractive standardization procedure for the underlying commodity. Relaxation of some of the standards may boost performance. In this context, flex contracts have recently been introduced on several commodities in the United States.

In this paper, we make a first attempt to integrate the two streams of research in order to improve the insight into the viability of commodity futures contracts. Evaluating the financial-economic aspects of the commodity and contract shows that hedging effectiveness has an important influence on volume. The market pays not only attention to basis risk, but also market-depth risk, as indicated by the stronger relationship between hedging performance and volume when market depth risk is being taken into account. We further elaborate on the farmers' characteristics that influence their use of futures contracts. In contrast to previous research regarding the use of futures contracts, we acknowledged the fact that farmers operate firms where all functional departments are combined. Perceptions and psychometric constructs may influence farmers' marketing behavior. Farmers are not homogenous regarding the factors influencing their use of futures. For different segments,

different factors are found. The heterogeneity at the segment level masks significance effects at the aggregate level (notably the effects of risk attitude, perceived risk exposure, and debt-to-asset ratio). The two streams of research both identify factors that influence the use of futures, and hence, in combination with each other, provide information valuable to futures exchanges for the design and delivery of their hedging services.

## 6. Research agenda

The perspective on the existence of futures markets has evolved over time to the current institutional perspective that is complemented by the transaction-relation approach. The latter incorporates a significant behavioral component, resulting from the underlying decision-making process of farmers participating in the market. Therefore, behavioral aspects of market participants must be taken into account when investigating the success of futures contracts.

Agricultural raw materials, for example, are becoming ever more differentiated. Do these relatively small product groups offer opportunities for futures trade? Most experts will point out that the liquidity would be too low, resulting in an unsuccessful futures trade. We question this line of thought and argue that the temporary order imbalances that occur influence liquidity or market depth, which not necessarily driven by volume. Due to these order imbalances, contracts may not be traded at their equilibrium price, causing an unnecessary decrease in hedging capacity for the participants in the futures market. The issue of liquidity at low volumes will gain importance for futures markets. Therefore, research that focuses on the possibility of futures trade in agricultural raw materials, such as biological raw materials, at relatively low trading volumes is a promising area of research. Changes in the specific marketing channels are also creating prospects for futures trade on products like flowers and plants, where risk has traditionally been shifted to the consumer.

Futures market research tends to be context sensitive. It studies a particular futures contract with a particular underlying value. This might lead us to the assumption that farmers are interested in covering price risks. However, this is not necessarily the case. The farmer is interested in those risks associated with the profit. The profit is the result of the farmer's entire production process, i.e. of all the products and services purchased and sold. Exactly for this reason, futures market research should focus on the entire underlying production process (PENNINGS and LEUTHOLD, 2001). A complex of futures contracts should therefore be studied simultaneously. This carries important implications for futures markets. One could ask which futures contracts reinforce one another, or, in other words, what the optimal portfolio of futures contracts looks like. The reason for the success of the soybean futures contract at the Chicago Board of Trade, for example, is the simultaneous listing of soybean meal and soybean oil futures. Finding the combinations of futures contracts that reinforce each other, and thus contribute to the success of a futures market, should have high priority on the research agenda. This type of research is also relevant to the planning and evaluation of exchange mergers: a prudent merger might profit from the mutual reinforcement of certain futures contracts.



The underlying markets of commodity futures are changing, sometimes with far-reaching consequences for the specifications of the futures contract itself. One example is the potato market. As more varieties enter the market, the needs of the farmers might no longer be met by a futures contract that specifies each variety. The issue that arises out of this is whether a futures contract that consists of a basket of varieties should be specified, or whether all the individual components of potatoes should be included in the contract specification.

These and other research questions can most successfully be investigated by the proposed integrated approach, as neither the financial-economic nor the behavioral approach alone can provide sufficient insight and information to exchange managers. The importance of the integration of both approaches is illustrated by the discovery that high hedging effectiveness alone does not guarantee high trading volume, a result that would not have been found by using either one of the approaches individually. Maybe in further research, both the financial and the behavioral approach should be expanded, such that they not only include our theory about using futures, but incorporate this theory into the analysis of market channel relationships in general.

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